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uninterruptedly in such a manner that the existence of comparatively recent lava-streams could be assumed.

No one can deny the importance of the study of lunar phenomena in relation to terrestrial geology. We see here, as it were, our own globe in its infancy. In both celestial bodies the following phases can be classified:

I. Fusion of the lithosphere in large plains. (*Mare Serenitatis;* not observable on the Earth.)

II *a*. Fusion without reaching the surface. (*Batholithes*, granite of the *Erzgebirge;* not known on the Moon.)

II *b*. Fusion-hearths of small diameter; quiet boiling of lava. (Hawaiian volcanoes: *Ptolemaeus*, *Wargentin*.)

III. Formation of fissures, narrow chimneys, and rhapsodic explosions. (*Laki*-fissure, *Vesuvius;* crater-rills, *Hyginus*.)

Finally, as local consequences of single eruptions, we mention the different phases of fumaroles which have been assumed to exist on the Moon also.

PLANET NOTES FOR JULY AND AUGUST.

By Professor Malcolm McNeill.

July.

Mercury passes inferior conjunction with the Sun on the morning of July 1st, and becomes a morning star. It moves rapidly away from the Sun, and reaches west elongation on the evening of July 22d. For the rest of the month it rises a little less than an hour and a half before the Sun, and is in good position for observation.

Venus is in good position for evening observation. It reaches greatest east elongation, 45° 31′, on the morning of July 11th. It then remains above the horizon $2^h\ 20^m$ after sunset. This is not as long as it was during June, although the distance from the Sun is greater. This shortening of the time between sunset and the setting of the planet is due to the fact that the planet is far to the south of the Sun; and the difference of declination increases throughout the month, so that on July 31st the planet sets less than two hours after sunset.

Mars is becoming harder to see as it gradually draws nearer to the Sun. By the end of the month it sets only about an hour after sunset; and it it will, after that, be practically impossible to see it with the naked eye until winter, after it has passed conjunction with the Sun, and come out on the other side far enough to be seen as a morning star before sunrise. It can probably be seen during the first part of the month, but it has nearly reached its minimum brightness, and it will not be an easy object. There will be a very close conjunction with the Moon on July 22d, and the planet will be occulted in some parts of the country shortly before the two-day-old Moon sets.

Jupiter is too near the Sun for good observation. It is in conjunction with the Sun on July 10th, and changes from an evening to a morning star. By the end of the month it rises rather more than an hour before sunrise, and may be seen under good weather conditions.

Saturn is in good position for evening observation. It is on the meridian a little before sunset on July 1st, and may be seen in the southwestern sky until nearly 1 A.M. At the end of the month it sets two hours earlier. It retrogrades until July 4th, and then begins to move slowly eastward among the stars, but the whole motion is only about equal to the Moon's diameter. It is about 10° east of the first magnitude star *Spica*, *Alpha Virginis*.

Uranus is in the constellation *Libra*, and follows after *Saturn* about an hour, and is about 7° south. It retrogrades slowly until July 24th, and then begins to move eastward, the westward motion being about a semi-diameter of the Moon. The easiest star by which to identify the planet is the third magnitude *Alpha Libræ*. The planet, about sixth magnitude, is 2° east and 1° south of the star.

Neptune is to be seen in the morning shortly before sunrise, but only by the aid of a telescope, it being too faint for naked-eye observation. It is in the constellation *Taurus*.

AUGUST.

ECLIPSE.—There will be a partial eclipse of the Sun on August 20th, visible only in northeastern Europe and northwestern Asia. The maximum obscuration of the Sun will be a little more than one-fourth of its diameter.

Mercury is a morning star at the beginning of the month, rising about 1^h 20^m before the Sun. The distance between planet and Sun rapidly lessens, and superior conjunction occurs on August 17th. The planet may be seen for a few days at the beginning of the month. There is a very close conjunction with *Jupiter* on August 1st. The least distance between the planets is only 9′, but this occurs after sunrise in this country.

Venus is still an evening star, but is rapidly drawing nearer to the sun, and on August 31st sets only half an hour later. It is, however, at its maximum brightness during the month, as it is now about half-way between elongation and inferior conjunction; and will be bright enough to be seen by daylight, if one knows where to look for it. It is about 16° south of the Sun, and its distance east of the Sun varies from 41° on August 1st to 21° on August 31st.

Mars is still an evening star, but is too close to the Sun to be seen by the naked eye. At the end of the month it sets a little more than half an hour after sunset.

Jupiter is a morning star, and is getting far enough away from the Sun to be conspicuous in the early morning. At the beginning of the month it is 7° south of *Pollux (Beta Geminorum)*, and during the month it moves about 6° eastward.

Saturn is still in good position for observation, but sets two hours earlier than during the corresponding part of July. It moves eastward about 2° in the constellation *Virgo*, and on August 31st it is about 40′ south of the fourth magnitude star *Kappa Virginis*. The rings which narrowed up very slightly during May and June are now widening again, and at the end of the month the ratio of minor to major axis is about $\frac{3}{10}$. The minor axis of the rings is about two-thirds of the polar diameter of the planet.

Uranus still keeps its position relative to *Saturn*, following after it about an hour. It is in the constellation *Libra*, and moves slowly eastward during the month a distance about equal to the Moon's diameter. It may still be identified by its position relative to *Alpha Libræ*, a little more than 2° east and 1° south.

Neptune is to be found in the constellation *Taurus*, in the early morning hours before sunrise.

EXPLANATION OF THE TABLES.

The phases of the Moon are given in Pacific Standard time. In the tables for Sun and planets, the second and third columns give the Right Ascension and Declination for Greenwich noon. The fifth column gives the local mean time for transit over the Greenwich meridian. To find the local mean time of transit for any other meridian, the time given in the table must be corrected by adding or subtracting the change per day, multiplied by the fraction whose numerator is the longitude from Greenwich in hours, and whose denominator is 24. This correction is seldom much more than 1^m. To find the standard time for the phenomenon, correct the local mean time by *adding* the difference between standard and local time if the place is west of the standard meridian, and *subtracting* if east. The same rules apply to the fourth and sixth columns, which give the local mean times of rising and setting for the meridian of Greenwich. They are roughly computed for Lat. 40°, with the noon Declination and time of meridian transit, and are intended as only a rough guide. They may be in error by a minute or two for the given latitude, and for latitudes differing much from 40° they may be several minutes out.

PHASES OF THE MOON, P. S. T.

		H. M.
Full Moon,	July 6,	3 29 P. M.
Last Quarter,	July 14,	7 31 P. M.
New Moon,	July 21,	9 32 P. M.
First Quarter,	July 28,	12 36 P. M.

THE SUN.

1895.	R. A. H. M.	Declination. ° ′	Rises. H. M.	Transits. H. M.	Sets. H. M.
July 1.	6 41	+ 23 8	4 36 A M.	12 4 P.M.	7 32 P.M.
11.	7 22	+ 22 7	4 42	12 5	7 28
21.	8 2	+ 20 29	4 50	12 6	7 22
31.	8 42	+ 18 17	4 58	12 6	7 14

MERCURY.

July 1.	6 40	+ 18 38	4 53 A.M.	12 3 P.M.	7 13 P.M.
11.	6 22	+ 18 50	3 56	11 6 A.M.	6 16
21.	6 37	+ 20 34	3 24	10 41	5 58
31.	7 30	+ 21 37	3 34	10 55	6 16

Venus.

1895.	R. A. H. M.	Declination. ° ′	Rises. H. M.	Transits. H. M.	Sets. H. M.
July 1.	9 49	+ 14 40	8 18 A.M.	3 12 P.M.	10 6 P.M.
11.	10 26	+ 10 29	8 30	3 9	9 48
21.	10 59	+ 6 7	8 38	3 3	9 28
31.	11 27	+ 1 46	8 42	2 51	9 0

Mars.

July 1.	9 3	+ 18 10	7 17 A.M.	2 25 P.M.	9 33 P.M.
11.	9 27	+ 16 16	7 12	2 11	9 10
21.	9 52	+ 14 11	7 3	1 55	8 47
31.	10 16	+ 11 57	6 56	1 40	8 24

Jupiter.

July 1.	7 9	+ 22 39	5 6 A.M.	12 32 P.M.	7 58 P.M.
11.	7 19	+ 22 23	4 38	12 2	7 26
21.	7 29	+ 22 5	4 10	11 32 A.M.	6 52
31.	7 37	+ 21 45	3 43	11 3	6 23

Saturn.

July 1.	13 57	− 9 18	1 48 P.M.	7 19 P.M.	12 50 A.M.
11.	13 57	− 9 21	1 9	6 40	12 11
21.	13 58	− 9 28	12 31	6 1	11 31 P.M.
31.	13 59	− 9 38	11 53 A.M.	5 23	10 53

Uranus.

July 1.	14 55	− 16 20	3 10 P.M.	8 16 P.M.	1 22 A.M.
11.	14 54	− 16 18	2 30	7 36	12 42
21.	14 54	− 16 17	1 51	6 57	12 3
31.	14 54	− 16 17	1 11	6 17	11 23 P.M.

Neptune.

July 1.	5 2	+ 21 21	3 4 A.M.	10 24 A.M.	5 44 P.M.
11.	5 3	+ 21 23	2 26	9 46	5 6
21.	5 4	+ 21 25	1 49	9 9	4 29
31.	5 6	+ 21 26	1 10	8 30	3 50

PHASES OF THE MOON, P. S. T.

		H. M.
Full Moon,	Aug. 5,	5 51 A. M.
Last Quarter,	Aug. 13,	9 18 A. M.
New Moon,	Aug. 20,	4 56 A. M.
First Quarter,	Aug. 26,	9 43 P. M.

THE SUN.

1895.	R. A. H. M.	Declination. ° ′	Rises. H. M.	Transits. H. M.	Sets. H. M.
Aug. 1.	8 46	+ 18 2	4 59 A.M.	12 6 P.M.	7 13 P.M.
11.	9 24	+ 15 17	5 9	12 5	7 1
21.	10 1	+ 12 8	5 18	12 3	6 48
31.	10 38	+ 8 39	5 28	12 0	6 32

MERCURY.

Aug. 1.	7 38	+ 21 34	3 37 A.M.	10 58 A.M.	6 19 P.M.
11.	8 59	+ 18 44	4 30	11 40	6 50
21.	10 18	+ 12 24	5 34	12 20 P.M.	7 6
31.	11 25	+ 4 47	6 29	12 48	7 7

VENUS.

Aug. 1.	11 29	+ 1 21	8 41 A.M.	2 49 P.M.	8 57 P.M.
11.	11 50	− 2 38	8 36	2 31	8 26
21.	12 2	− 5 56	8 21	2 4	7 47
31.	12 3	− 7 59	7 48	1 25	7 2

MARS.

Aug. 1.	10 18	+ 11 43	6 56 A.M.	1 39 P.M.	8 22 P.M.
11.	10 42	+ 9 21	6 49	1 23	7 57
21.	11 5	+ 6 53	6 41	1 7	7 33
31.	11 29	+ 4 19	6 33	12 51	7 9

JUPITER.

Aug. 1.	7 39	+ 21 43	3 40 A.M.	11 0 A.M.	6 20 P.M.
11.	7 48	+ 21 21	3 10	10 29	5 48
21.	7 57	+ 20 59	2 40	9 59	5 18
31.	8 5	+ 20 35	2 10	9 28	4 46

SATURN.

Aug. 1.	14 0	− 9 39	11 49 A.M.	5 19 P.M.	10 49 P.M.
11.	14 2	− 9 52	11 12	4 42	10 12
21.	14 4	− 10 8	10 36	4 5	9 34
31.	14 7	− 10 26	10 1	3 29	8 57

URANUS.

Aug. 1.	14 54	− 16 18	1 8 P.M.	6 13 P.M.	11 18 P.M.
11.	14 54	− 16 20	12 30	5 35	10 40
21.	14 55	− 16 23	11 51 A.M.	4 56	10 1
31.	14 56	− 16 28	11 13	4 18	9 23

NEPTUNE.

Aug. 1.	5 6	+ 21 26	1 7 A.M.	8 27 A.M.	3 48 P.M.
11.	5 7	+ 21 27	12 27	7 48	3 9
21.	5 8	+ 21 28	11 49 P.M.	7 10	2 31
31.	5 8	+ 21 28	11 10	6 31	1 52

SPECTROSCOPIC OBSERVATIONS OF *SATURN* AT THE ALLEGHENY OBSERVATORY.

By Dr. James E. Keeler.*

As certain observations of mine on the spectrum of *Saturn* have been widely noticed by the daily press, and various reports have been spread, some of which are correct and some incorrect, but none of which were made by my authority, I take this opportunity to explain the real character of the observations. It is hardly necessary for me to say here that I have made no "claims" whatever respecting them.

The observations furnish a direct proof of the accepted hypothesis that the ring of *Saturn* consists of a multitude of small bodies revolving around *Saturn* in circular orbits. The hypothesis is an old one, but its universal acceptance dates from the publication of MAXWELL'S prize essay in 1859. While the mathematical proofs given by MAXWELL and his predecessors

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